Alternative: Gaining Water Use Efficiency (Reducing Water Use Demand) in the Jemez y Sangre Region

Acknowledgements: This white paper was produced by Daniel B. Stephens & Associates, Inc., with assistance from the Jemez y Sangre Water Planning Council and with input from a water planning charrette held in February 2002. Contributing authors include Tom Ash, Irvine Ranch Water District, Alletta Belin (legal), and Bonnie Colby (socioeconomic).

1. Summary of the Alternative

The Jemez y Sangre planning region is subject to extended and severe drought and regularly experiences water shortages and peaking problems. One possible solution to these problems is water demand reduction, a generally low-cost, environmentally sound method for meeting water demands for a community as opposed to supply-side water management (infrastructure increases). However, achieving meaningful and long-term demand reductions requires an integration of a wide variety of actions to realize the benefits of efficient use of water across the different customer groups. This white paper addresses some of these actions, including (1) conserving water through lifestyle changes, (2) utilizing gray water, and (3) minimizing use through incentives, efficiency improvements, and accountability. Demand reductions from reducing losses in conveyance systems and agricultural irrigation systems are discussed in a separate white paper (DBS&A, 2002).

In the Jemez y Sangre region, residential and tourism-related uses top the list of water demands, with the exception of irrigated agriculture. With an estimated projected population growth of 17 percent over the next 20 years, a comprehensive conservation program could help meet nearly all the water needs without any increase in supply. At a minimum, however, water conservation is necessary to combat drought conditions and peak day problems. The benefits to the community for achieving water efficiency would be (1) reduced costs for infrastructure, (2) improved environmental quality, and (3) lower water bills for the public.

Studies show that an incentive water pricing structure significantly affects water use decision making and can determine the effectiveness of conservation programs. Approximate water savings potential is 15 to 30 percent for indoor use and 40 to 50 percent for outdoor use,

depending on how wasteful the current uses are. Significant savings have been demonstrated in Orange County, California where an incentive pricing structure by the water utility has resulted in a 54 percent reduction in usage for landscape watering and a 12 percent reduction in indoor residential use.

Incentive rate structures implemented by water utilities and mutual domestics should therefore be a key component of a successful water conservation program in the Jemez y Sangre region. Using the market system in this manner will make end users aware of their water use habits and give them concrete incentives to modify their own water use behaviors. Appropriate incentive rates structures can (1) stabilize agency revenue, (2) send conservation messages to customers, and (3) fund all aspects of conservation programs, such as promotion, education, and rebates for customer upgrades.

To save water on a long-term and consistent basis, the local agencies need to:

- Know their customers use habits (data).
- Make water conservation important (by establishing incentive rates) and credible (use science to create customer allocations).
- Provide ongoing education and outreach to all customer groups on how to save water.
- Encourage the installation of conservation fixtures (efficient water use toilets, showerheads, sprinklers, evapotranspiration (ET) controllers, low-flow washing machines, etc.) through rebates or other incentive programs.
- Establish efficiency in new developments through regulations, and incorporate requirements for retrofitting existing development as a condition for building new development.
- Monitor and support customers' efforts to save water.

This white paper describes these program elements, their value as conservation tools, the typical costs of conservation programs, and the benefits the community can expect to gain.

2. Technical Feasibility

All across the country, water agencies have implemented a wide range of water conservation programs. Most have had short-term impacts, while a few communities have gained long-term reductions. Many water conservation programs start and stop with public education. Other programs attempt to reduce demand through ordinances, but do not supply monitoring and enforcement. The most sophisticated programs employ modern technological methods to achieve significant usage reductions. However, some of the more sophisticated technological approaches, such as determining individual water budgets for every customer, cannot be easily implemented within smaller water systems, which generally do not have adequate recordkeeping or management system capabilities to apply this approach. Financial and technical assistance will be required for such systems to achieve significant water savings with these methods.

The hope of public agencies is that education and ordinances will prompt end users to become efficient with water resources and use only what they really need. These measures have had limited success in some areas:

- Studies by the Metropolitan Water District of Southern California show that the effects of education programs last only a few months. In reviews of home water audits by the Metropolitan Water District, residents returned to pre-audit water use behaviors in less than four months. Education, without proper incentives, has not reduced water use, except for short periods.

- Conservation related ordinances have in some cases not proven to be effective at reducing water use as intended, particularly those that single out specific business areas. For example, when landscape ordinances allow watering only two days per week, residents are found to over-water on their allotted days (Georgia, Oregon, Texas

and Colorado). The desired effect for water use reductions ends up as an overall increase in water use. When all landscape watering is banned, landscape businesses suffer, tourism is affected, and property values decrease.

However, the City of Santa Fe has effectively reduced the demand on the water system by implementing conservation ordinances that restrict watering to three days a week during stage 2 and one day a week during stage 3. While this is effective in managing a water shortage crisis, a more sophisticated approach would allow residents to maintain their gardens and reduce the water demand.

To date, conservation programs in New Mexico have included:

- School education programs
- Water-wise/xeriscape landscape education (Rio Rancho, Las Vegas, Albuquerque)
- Home water audits (Albuquerque)
- Low-flow toilet rebates (Albuquerque, Las Vegas, Rio Rancho)
- Commercial industrial programs (Albuquerque)
- General public education (Las Cruces, Albuquerque, Santa Fe, Rio Rancho)
- Inclining rates (Albuquerque, Gallup, Las Cruces)

This section outlines an integrated approach to achieving long-term water conservation. The approach seeks to (1) affect lifestyle changes in a fair and equitable manner, (2) send clear conservation signals to customers through the prices for efficient and inefficient water use, (3) provide public education to help keep water bills low, (4) provide further incentives to retrofit sites, both inside and out, (5) establish regulations for efficiency in new development, and (6) suggest monitoring water use and targeting water waste as a core public agency task.

The sequence of a suggested conservation program is:

1. Collect customer data
2. Establish incentive water rates

3. Provide public education
4. Fund retrofits and rebates
5. Set new development requirements
6. Provide user support and monitoring

2.1 Collect Customer Data

Understanding both the current community water use patterns across the different types of water user groups and the real needs of the customers is the first step in developing the best tools to save water in a given area. When the actual use of water (demand) is compared with the actual need (efficiency level), the difference is the conservation potential. The potential for water savings determines which efforts should be undertaken and when it becomes cost-effective to implement them. Once the water savings potential has been determined for a customer group, the conservation strategy comes quickly into focus.

Water use histories of individuals and of water use group type (i.e., hotels, business office, apartment, detached single-family home, etc.) must be collected and analyzed. Some billing systems may not have customer codes in place to easily identify water use patterns for customer groups. Therefore collecting and analyzing data may require field observations and customer surveys.

Major water use groups will vary by community. In Albuquerque, the commercial industrial sector is a large user of water along with landscapes. In Santa Fe, indoor use in homes, hotels, and the commercial sector accounts for 75 percent of the water on an annual basis, but only about 50 percent during summer months when landscaping demands are high, accounting for the other 50 percent. In Los Angeles, most of the water goes to interior residential use. Knowing who and how water is used is key to creating a successful conservation program.

Numerous studies funded by the American Water Works Association (AWWA) provide guidelines for how much water various user types require (Mayer et al., 1999). Efficient home and landscape water use is generally well understood. Commercial and Industrial water use is much more variable and unique to each business setting.

Standards for water use efficiency can be applied to each water use group, based on local conditions and a body of AWWA research related to actual consumptive needs. These types of standards are used to determine what the water savings potential is for the customer group and/or the community. The standards for water use needs of various customer groups include:

- *Detached single family residential need:* Interior (per capita use per resident) plus exterior (vegetation consumptive demand for irrigated area). Vegetation demand varies with type, site, and weather conditions and may be computed from real time ET station data and site-specific information on landscape vegetation types and areas for each customer

- *Multi-family/apartment residential need:* Interior (per capita use per resident)

- *Dedicated meter commercial landscape need:* Vegetation consumptive demand for irrigated area

- *Mixed use commercial need:* Interior (per capita per employee plus process water) plus exterior

- *Agricultural need:* Crop consumptive demand for irrigated area

This type of information can be used to develop an individual water budget for every customer. The water budget then provides the basis of the incentive price structure for each customer. Much of this data collection and analysis is typically contracted out by local water agencies to consultants because (1) the process requires specific skills and experience, and (2) contracting saves the local agency from creating new positions for short-term projects.

2.2 Establish Incentive Water Rates

The U.S. Bureau of Reclamation (USBR) states that, “The price of water affects the decisions regarding water use and therefore can be a key component of demand management” (USBR, 1997, p.1). Inducing lifestyle changes in terms of water use will depend upon the pricing set by

the local water agency. An effective "incentive" rate structure drives all conservation activities by the agency and the community. Therefore, the first step in reducing water demand is to develop the appropriate water rate structure.

1. Collect appropriate customer data to develop water budgets and incentive water rates
2. Determine (from the collected data) where water is used and how efficiently it is used
3. Establish water use allocations (efficiency levels) for customers, prices, and rate policies
4. Test the rate structure with real-time customer data
5. Make billing system (software, hardware, etc.) changes to deliver the rate structure
6. Implement rate structure with appropriate public education and marketing, or implement rates during a drought to leverage general public awareness

When a conservation rate structure is implemented, the agency will automatically see who wastes water. The end users will automatically experience an economic incentive to reduce water use (if they waste water) and will seek the assistance of the water agency. At this point, the traditional conservation programs become most effective.

The most effective incentive rate structures meet the following goals:

- They stabilize agency revenue despite reduced water use.
- They send clear signals to customers.
- They create conservation "self-funding" from excess revenues (i.e., revenues from increasing rates for wasted water).

2.2.1 Costs to Implement Incentive Water Rates

The main costs of implementing incentive water rates are related to billing system software and any computer hardware needs to handle a more sophisticated billing system. These costs depend upon the existing billing system of the local agency. In one example agency in California (serving 150,000 people), the software development and public education costs to implement the rate structure were approximately $100,000 in 1991. However, by 2000, the rate structure had saved customers more than $30 million dollars (90,000 acre-feet) in avoided water purchases.

2.2.2 Incentive Water Rates as the Funding Mechanism for Community Conservation

A tiered rate structure, with water budget allocations for each customer, includes increased charges for water that is wasted (or water use above the given allocation). Since the fixed agency costs are automatically recovered in the service charge, any revenue collected beyond the base cost of water is excess revenue. This revenue becomes the self-funding mechanism for implementing conservation programs, including low-flow plumbing retrofits and landscape upgrades.

2.3 Provide Public Education

Along with incentive water rates, the agency needs to provide a comprehensive public education program. Customers will need assistance and information on how to save water to keep their bills low. The following public education topics are appropriate for the Jemez y Sangre region:

- Money savings possible with efficient water use
- Amounts of water use appropriate for each category of water user
- Techniques for identifying leaks
- Techniques for reducing interior water use
- Techniques for reducing landscape water use
- Rainwater harvesting
- Recycled water use / gray water use
- Business water use efficiency
- Environmental benefits of water efficiency

2.4 Fund Retrofits and Rebates

To gain water demand reductions, it is important to ensure that efficient water use appliances are distributed and installed. The greatest water savings in the Jemez y Sangre water planning region can come from upgrading the plumbing in existing homes and businesses. A single low-

flow toilet (1.6-gallon flush) will save 12,000 to 16,000 gallons of water in a single year when compared to toilets that are more than 10 years old.

Reducing landscape water requirements can (1) reduce peak water problems in hot months or during water shortages, (2) reduce overall demands, and (3) reduce nonpoint source water pollution in the local area. For example, in Santa Fe, peak water demand can be reduced approximately 25 percent with efficient landscape water use. Reducing landscape water use in the short term requires two actions: (1) improving irrigation efficiency with system upgrades (fixing sprinkler leaks, reducing pressure, etc.) and (2) applying only the amount of water that landscapes require (through scheduling). Reducing water use in landscapes over the long term entails, in addition to those items listed above, changing the plant materials from species with higher water requirements to those with lower water requirements. However, regardless of plant species, efficient irrigation systems and people who apply the right amount of water in relation to weather changes constitute the best opportunity to save landscape water. Rebates can speed the upgrading of landscapes and irrigation systems to help reduce overall demand and peaking.

Water audits can be conducted to evaluate the water savings potential on a site. These can be made mandatory for all or selected groups of users, in which case a time period should be established for audits to be completed, commercial and industrial sites should be required to use a certified water auditor, and a report should be submitted to the local and state water authorities. Audits can identify where rebates can have the most impact.

The following retrofitting measures are recommended:

- For existing homes
  - Low-flow plumbing devices (all types of homes, including apartments)
  - Landscape irrigation systems, plant changes
  - Rainwater harvesting (single family homes, condos)
  - Metering
  - Sub-metering for apartments

- For existing businesses:
  - Low-flow plumbing devices
  - Process water uses
  - Cooling towers
  - Recycled water
  - Metering
  - Landscape irrigation and water-wise plant materials
  - Mandates and financial incentive programs

Retrofits can be required through "retrofit on resale" requirements that mandate the installation of low-flow plumbing devices in residences (with the cost borne by the seller or buyer) as a condition of sale. In addition, financial incentives for installing retrofits and implementing other water-saving measures can be provided through rebates, such as:

- Rebates for low-flow plumbing devices for homes and apartments
- Rebates for upgrading landscape plantings (from high water use to low water use plants)
- Rebates for irrigation system upgrades (residential and commercial)
- Rebates and/or tax incentives to install rainwater harvesting systems (residential and commercial)
- Rebates and/or tax incentives for businesses to upgrade plumbing and process water systems (particularly important in the hotel and restaurant industry, which is so prominent in this region)

In Santa Fe 75 percent of the annual water use occurs inside, suggesting that the distribution of low-flow plumbing devices could achieve significant reduction in water use. During the summer, more than 50 percent of the demand is due to outdoor irrigation, again indicating that irrigation efficiency and plant materials changes are areas where significant savings could be gained.

Analysis shows that retrofitting the sites that have the highest savings potential with low flow plumbing could save at least 25 percent of their current total annual water use. Retrofitting low-flow plumbing devices lowers overall demand and reduces peak use reliably without behavior changes. In this region, the highest potential retrofit candidates are:

- Hotels
- Apartments
- Senior apartments
- Restaurants
- Condominiums
- Detached single family homes
- Business offices

The cost to distribute such low-flow toilets and showerheads would be approximately $350 to $500 per acre-foot, as opposed to a cost for existing water of $600 per acre-foot and a cost for new infrastructure needed to serve increasing population of $675 to $1,400 per acre-foot (or more than $5000 per acre-foot if new water rights are required). Thus typical low-flow plumbing distribution/installation programs would be cost-effective for this community.

2.5 Set New Development Requirements

Planning and design guidelines are needed to ensure that all new development uses water efficiently. Since low-flow plumbing devices are a national building standard, landscaping and the use of recycled water become the main focus of these regulations. These regulations should cover:

- Grading for stormwater harvesting (parking lots, driveways, medians, etc.)

- Grading and landscape design guidelines (homes, streets, parking lots, etc.)

- Watershed management (wetlands for storm water retention) within larger development areas

- Xeriscape landscape design

- Installation of ET signal controllers and rain shut-off devices

- Installation of rainwater collection systems where paved surface areas make it feasible

- Recycled water use (mandatory for large landscapes)

- Requirements for the use of reclaimed water where available (including in offices for toilet flushing, car washes)

- Metering
  - Mandate dedicated landscape meters
  - Require all commercial sites to have separate interior and exterior water meters
  - Require all residential sites to have meters (even where wells are the source of water)

- Requirements for installation of an ET weather station in specific micro-climate areas (given to the state for ET weather network) for use in public education and billing.

- Builder mitigation options (to gain the water needed to serve new areas)
  - Conservation devices (e.g., requirement for new development to provide retrofitting of existing development as a condition for building, thus freeing up water for the new uses)
  - "New water" requirement (e.g., assisting with the funding of conservation efforts, such as recycled water programs, low-flow plumbing devices, public education, etc.] to ensure adequate water supplies for the community)

2.6 Provide Support and Monitoring

Water agency staff should be trained to educate and assist customers with water conservation issues, including using water efficiently, using weather stations, understanding computerized billing data, and other issues arising from water conservation programs.

3. Financial Feasibility

Typically, water conservation is a low-cost method to gain "new" water supplies. Its cost effectiveness is determined by comparing the cost to save water, typically $350 to $500 per acre-foot, with the cost to buy or develop new water sources.

The proper "incentive" rate structure can fund long-term conservation efforts. However, many agencies find it difficult to get started with data collection, rate design and implementation, and other measures such as rebates on low-flow toilets. A model program designed in Utah may be a solution for water agencies in the Jemez y Sangre region.

Various state and federal funding sources could be used for conservation programs. Examples include:

- State startup assistance program (zero interest revolving fund), where the state provides money to fund rate structure development. Once the local agency can implement an incentive rate structure and gain excess revenue, the State is refunded the startup money (Utah example).

- State bond issues raising money for water related projects (California example).

Financial assistance will be important for smaller water systems in the Jemez y Sangre region that otherwise lack the funding capacity to provide effective reduction measures such as low-flow retrofits.

Alternatively, implementation and long-term operational costs can be funded directly through the local incentive rate structure. The incentive rate structure was developed in California, in part, to help make local funds available for local conservation efforts. In philosophy, those who waste water pay the "marginal" costs for water (which is higher than the cost to deliver a unit of water today). This excess revenue (above the base rate cost of water per unit) is then used to help make any and all users efficient. The ability to fund conservation efforts from the incentive rate structure is a prime reason to establish incentive rates up front, before serious conservation efforts begin. If any demand reduction takes place for whatever reason, agency revenues will go down. Therefore, the effective conservation rate structure captures all the fixed revenue needs, regardless of how much water is used by the customer.

4. Legal Feasibility

There are no obvious legal barriers to individual water conservation measures such as gray water systems and other methods of increasing water use efficiency. Local governments and water service providers can, as a proper exercise of their police powers and in an effort to stretch limited water supplies, require that such conservation measures be established, as long as the costs imposed on individuals do not rise to such a level that, in effect, water service is denied entirely to people unable to afford the systems.

Each conservation program component presented in Section 2 is either in practice by some water agency in the U.S. or is being planned. For example, incentive water rates are not only recommended by the USBR, but will soon become mandated in California. Retrofit and rebate programs are commonly used to reduce water demands in every part of the country. New design requirements are commonly used by cities and water agencies, including mandating the use of recycled water (for appropriate uses) if it is available to the customer. In short, the local water agency has the legal authority to use every type of conservation method listed for the "benefit" of the community and does so in every corner of the country.

5. Effectiveness in Either Increasing the Available Supply or Reducing the Projected Demand

Based on reviews of water use in Santa Fe and surrounding communities and on program examples from around the country (i.e., those that have proven track records), the Jemez y Sangre region could gain significant water savings, as much as 30 percent, from the integrated use of the conservation program described in Section 2. The success of conservation will depend upon (1) the accuracy of the data, (2) the commitment of the local leaders, and (3) the thoroughness of the implementation. Communities that have implemented conservation programs have various levels of success; Albuquerque has reduced demand by 23 percent, Tucson by 30 percent, Los Angeles by 25 percent, Austin by 27 percent, and Irvine by 54 percent (landscape use) and 12 percent (residential use). Additionally, Santa Fe has reduced demand by 22 percent on a per capita basis since 1995.

If education and ordinances are the conservation methods of choice, conservation will be short-term and need reiteration every year. Crisis management, when water shortages appear, will be the norm. If incentive water rates are established, however, the effectiveness of conservation will be strong and persistent, and conservation will be a tool to better manage drought, peaking, or shortages.

6. Environmental Implications

Saving water among existing users through rates, retrofits, and new development guidelines is the most environmentally sound method to gain a new supply of water. No infrastructure (pipelines, reservoirs, diversions, wells, etc.) expansion is necessary to gain new water through conservation programs. Achieving water conservation in a community actually reduces the need to expand existing facilities (i.e., treatment plants, reservoirs, sewage disposal, etc.) that do have an environmental impact. Additionally, there is evidence that landscape conservation helps reduce nonpoint source water pollution.

7. Socioeconomic Impacts

Water conservation has happened in many types of communities across the country without negative impacts to business or lifestyle. The socioeconomic impacts of water conservation are largely favorable, both for residential and business customers. Water bills are reduced and more disposable income is available for other uses by the consumer. For example, it was determined that retrofitting low-flow toilets and showerheads in apartments throughout Santa Fe would reduce water bills by $300,000 per year for those customers. That money would be much more valuable by being spent in the community than it would by purchasing more of a scarce supply of imported water. With effective pricing signals and conservation incentives:

- Residential customers may make their own choices regarding how they use water, and presumably, every water user will make the right choice based on economics. If they make good choices, their water bills will be less. Indeed, conservation, particularly low-flow plumbing programs in apartment and senior communities, has a positive effect on low and fixed income homes.

- On the business side, conservation results in less need for expensive infrastructure, often funded by tax increases and/or higher water rates for all. Water conservation becomes a valuable tool for businesses to keep costs down (and profits up). For any business, a reliable supply of water is critical, and water conservation helps to ensure that water is available when customers want it and at the lowest possible cost.

Specific socioeconomic impacts of water conservation include:

- Water conservation creates jobs in a community performing efficiency services in businesses, landscaping, and plumbing.

- Water efficiency can be achieved without a diminished lifestyle (for example, through low-flow toilets, cooling towers, meters, etc.).

- Incentive rates encourage, rather than force, each end user to use water efficiently.

- Money saved by end users (avoided water purchases) benefits the individual and the local economy.

- Water conservation has a more positive impact on low-income families and seniors (i.e., the money saved through water efficiency is a greater portion of their income).

- Conservation has a positive environmental impact (which is a significant societal benefit).

Water conservation efforts cannot be completely effective without managing growth as well, and financial incentives are required to facilitate this course of action. Just a possibility of growth restrictions could be enough of an incentive to encourage developers to incorporate water saving technologies into new developments. Additionally, water users may be more likely to conserve if a growth management strategy is in place, because they will be less likely to feel that their conservation efforts are only going to support new growth.

8. Actions Needed to Implement/Ease of Implementation

Saving water requires a variety of information, skills/experience, computer hardware and software, and funding, such as:

- Willingness of decision makers

- Analysis of cost/benefits (costs of conservation programs versus existing costs of water and future infrastructure costs)

- Initial funding source(s)

- Conservation program implementation expertise

Some actions that could benefit the Jemez y Sangre region's water conservation efforts include:

- Working with the New Mexico Finance Authority and the New Mexico Environment Department to use existing water/wastewater grant funds to develop conservation programs and finance required infrastructure

- Educating agricultural users to better define actual crop water needs

- Lobbying the State Legislature to provide financial and technical assistance to smaller communities and systems for implementing efficiency improvement measures

9. Summary of Advantages and Disadvantages

Conservation can be another tool for local water agencies to use to gain “new” water supplies at a low cost. Conservation can significantly assist with groundwater management and in reducing treatment and wastewater infrastructure needs, environmental impacts from high water use, and customer water bills.

The prospects for saving water in the Jemez y Sangre region are very positive. With the exception of the City of Santa Fe, no coordinated, long-term conservation programs have been established, so the savings from rates and retrofitting will be immediate and deep. New development requirements will assist with maintaining efficient water use as population increases. This region has significant opportunity to meet the water needs of the future through integrated resource planning that incorporates conservation as a core feature.

The advantages of implementing water conservation are:

- Low-cost source of supply

- Environmentally sound

- Multiple benefits, including reduced wastewater treatment and reduced future infrastructure need

- Stretches existing supplies out into the future

- Reduces peak demand

Disadvantages of conservation programs are:

- They require data and computer technologies

- They require specific skills in landscaping, plumbing, and commercial water needs

- There are no real incentives for agricultural users to reduce usage under current state law

Many view conservation as something that has to be done, with no real alternative choice. The question is what and/or how to conduct the program.

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